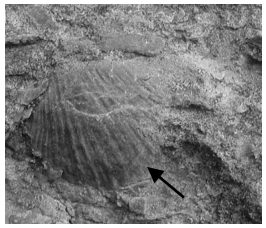
*When leaving a fossil dig in the Western U.S., a geology professor was asked by the ranch owner "How old did you say those fossils are?" The professor replied "About 230 million years." The rancher said "Ha! I suspected you weren't telling me the truth. That is exactly what you told me a full year ago."*

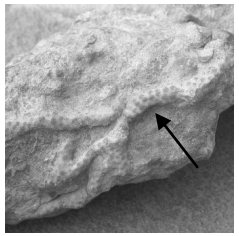
*--Mead Leroy Jensen, Yale University*

*This interpretive field guide is intended to make your visit to the quarry in Edwin Warner Park an enjoyable learning experience. Hopefully it will draw-out your best observation skills and make you think about change throughout geologic time on our dynamic Earth.*

*--Nature Center Staff*

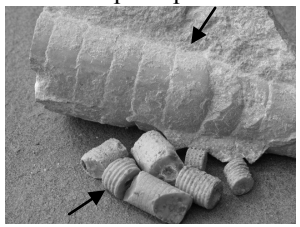


Brachiopod



Bryozoan

Cephalopod



Crinoid (stems)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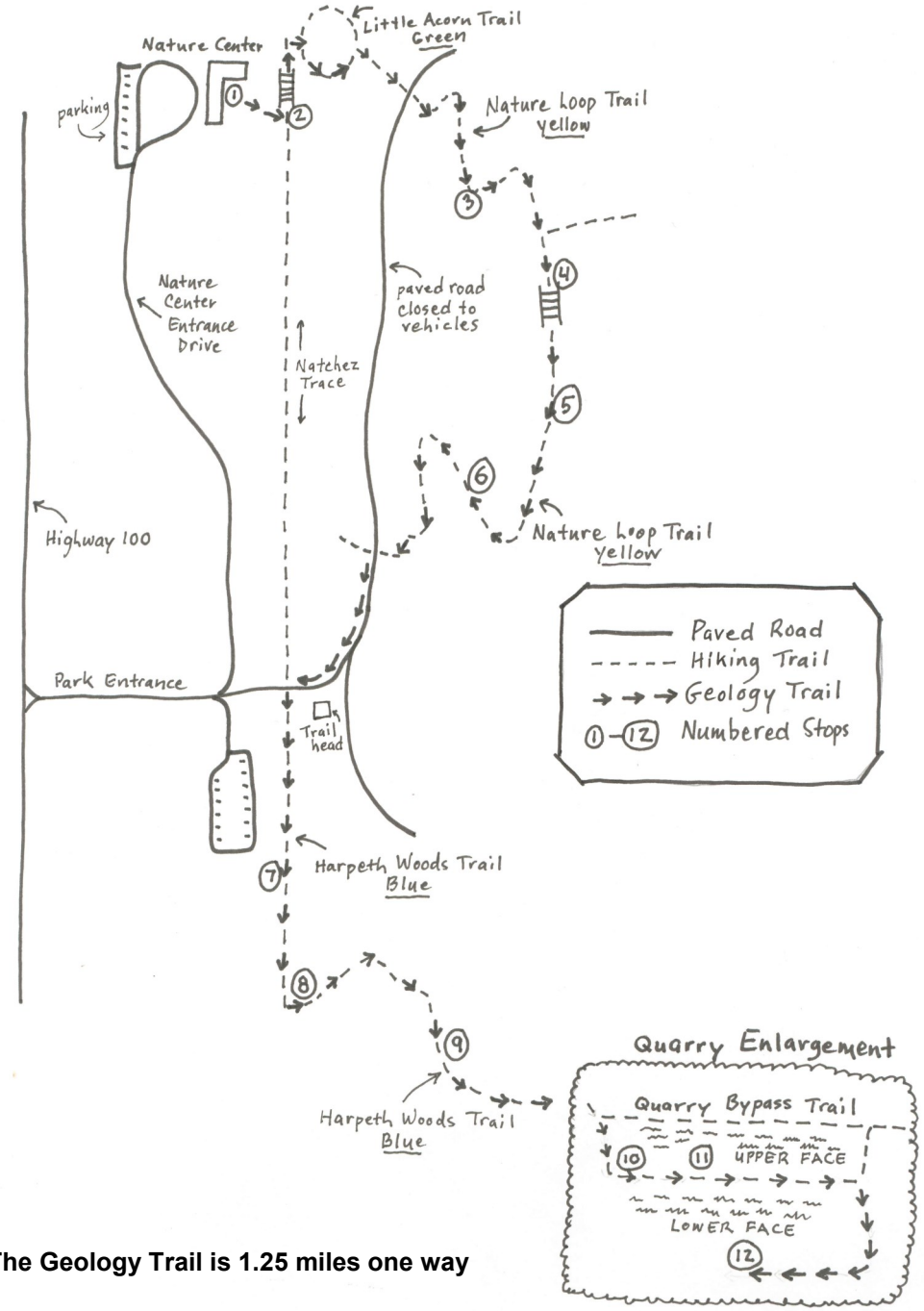
# A Walk Back In Time....

# The Geology Trail

# The Geology Trail




**The Geology Trail is 1.25 miles one way**

## On the way back, think about geologic time...

How long ago do you think the rocks in the quarry and the hills were deposited? A million years ago? A billion? The answer is about half a billion years, or 500 million! That length of time is difficult to understand! Sometimes it is easier to grasp geologic time if we think about it in terms of distance. Let distance represent time and let the width of one of the hairs on your head represent your current lifetime, which, let's say is 10 years! NOW, assuming this, how far back in **distance** is a 1/2 billion years?

Here's a hint: It is about the distance from the Nature Center to the quarry and almost back again! But to get an even better idea, let's step back in time using known events.

| **EVENT** | **TIME,** *in years or MYA (millions of years ago)* | **DISTANCE** |
|---|---|---|
| ***Forward in time*** | | |
| End of your life (assumed) | 70 | 1/2 width of a pin |
| ***Back in time*** | | |
| You were born | 10 | Width of a hair |
| Discovery of America | 520 | Width of 2" finishing nail |
| End of BC, beginning of AD | 2,000 | Width of your little finger |
| End of last Ice Age | 10,000 | Width of 3 fingers |
| First human to walk upright | 6 MYA | 100', 8 car lengths |
| Last flightless dinosaur | 65 MYA | 1100', 4 football fields |
| First dinosaur | 230 MYA | 3800', Quarry to Nature Center |
| Fossils and rocks in the quarry | 460 MYA | 7700',1¾ times Quarry to Nature Center |
| First abundant fossil record | 540 MYA | 9000', Round trip, Quarry to Nature Center |
| First record of life on Earth | 3,500 MYA | 11 mi, Nature Center to Metro Courthouse |
| Origin of Earth | 4,600 MYA | 14.6 mi, Nashville to Lavergne |
| Origin of Universe | 14,000 MYA | 43.6 mi, Nashville to Lewisburg |

***All this, starting from the width of a hair on your head!***

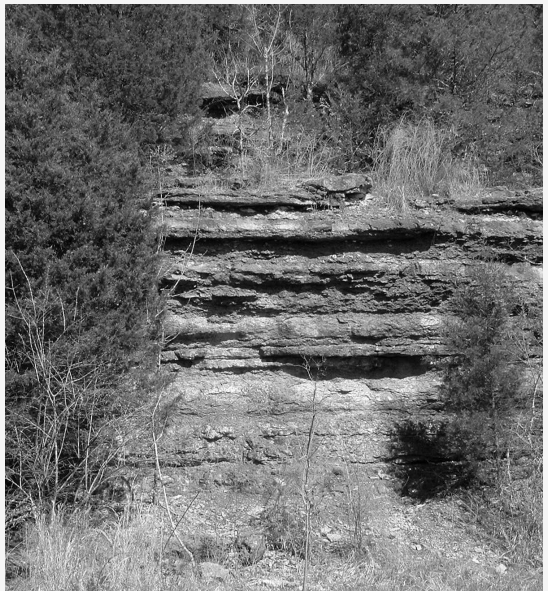
## Stop 12

Take a look at the quarry wall. Can you see the layers? The hard limestone layers form the ledges that jut out. The softer clay and sediment layers have weathered away, back into the recesses under the ledges. The layers continue on for the length of the wall. Do you think the layers continue on under the soil and hill where we cannot see? Certainly! This continuity of the layers and the abundance of marine fossils is evidence that the sediments were deposited into an ocean. Based on present-day accumulation of lime-rich sediments, it probably took about 20,000 years for this high wall to be deposited!

Today, the marine organisms that create limestone live in warm water within about 20 degrees of the equator. Nashville is about 36 degrees north of the equator in cooler water. But you are standing on limestone from an ancient ocean bed, so how could that be?

The most probable answer involves **plate tectonics.** Long ago, Nashville was much closer to the equator. In fact, when the rocks on the high wall were being deposited as sediment long ago, what is now Nashville and much of the mid-U.S. was part of a continent called "**Laurentia**." This continent was, at one time, about 15 degrees **SOUTH** of the equator near where Lima, Peru is today! Nashville really is on the move!

Take your time and examine the boulders in the center of the quarry floor and look all around. You never know what you may discover!



*To return to the Nature Center, retrace your steps to the road crossing between Stops 6 and 7. Here, continue straight across the road on the Harpeth Woods trail blazed blue. At the elevated bridge, turn left out of the woods to arrive back at the beginning.*

## Welcome to the Warner Park Geology Trail!

We hope you enjoy your walk through time and through the trails of the Warner Parks. You will be following sections of the Little Acorn trail blazed green; the Nature Loop, blazed yellow; the Old Roadway (paved and closed to cars); and the Harpeth Woods Trail blazed blue, which includes a section of the historic Natchez Trace.

The interpretive stops are indicated by limestone rocks with painted numbers which correspond to the numbered stops in this booklet.

Middle Tennessee and the Warner Parks have a rich geologic history which began hundreds of millions of years ago and continues today. From ancient seas to meandering creeks, Warner Parks tell a story of history and change.

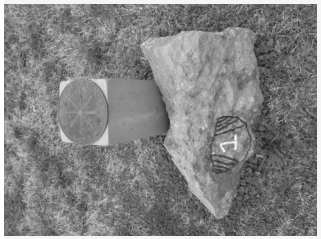
When enjoying your hike back in time, please remember that to preserve the diversity and landscape of the Park far into the future, we must observe the following rules:

1. Stay on the trail! By getting off of the trail, you can cause erosion, trample plants and degrade the habitat for wildlife.
2. Do not collect soil, rocks, fossils, shells, plants, animals or any other natural items. Removing natural objects prevents others from enjoying them, disturbs the ecosystem and is, by the way, illegal!
3. Please don't litter!
4. Have a great hike and enjoy the history and geology of YOUR Park!

*Take only pictures, leave only footprints*
*and kill nothing but time.*

## Stop 1

*We begin our trip through time at the compass on the Nature Center's rear stone patio.* Look out across this big grassy field toward the purple martin nest gourds. Have you ever wondered why there are so many flat fields and rolling hills in this area? When you walk into the woods, look straight ahead. There is your answer! Vaughn's Creek, over the last many thousands of years, even millions, cut this gentle even slope into the landscape. This creek was actually close to Hwy 100 at one time and it is still on the move! It is now undercutting the hills right before your very eyes!! As you approach, take a look at the tree roots that are now exposed because the creek **eroded** the soil away! Where will the creek move over the next million years?



*Walk straight across the field into the woods to arrive at Stop 2.*

## Stop 2

Now that you are at the creek, take a good look at the size and location of the rocks in the creek. See a pattern? Look closely and you will find that the larger rocks remain in the center, or creek channel, where the **water** is deeper and the flow is swifter during heavy rainstorms. The smaller rocks and sand are washed away and deposited where the water is shallower and slower.

If the water is low (usually in summer and fall), you can see slabs of limestone **bedrock** in the creek bottom just below the bridge. Now— look across at the bank. What do you see? Dirt? Well, not just dirt, but clay-silt soil. Lower, you see stream deposited **alluvium**, or gravel composed of limestone and chert. All of this has been **weathered** away from the bedrock of the **Fort Payne Formation** which is about 30 feet below the land surface and way up the hill This material has been slowly creeping down the hill. The creek sweeps the silt and clay away and deposits it downstream. This is known as **sedimentation** or **deposition**. *Cross the bridge, follow the green Little Acorn Trail and then the yellow Nature Loop Trail to arrive at Stop 3.*

## Stop 10

You are now entering the rock **quarry**. Much of the stonework you see in the Park, such as the walls along the roads, was quarried, or taken, from this location in the 1930's. Look for perfectly round holes in the ground which were drilled into the rock. Dynamite was dropped into the holes, lit and then "bang!" the rock face was blown off. The large boulders were then cut into the desired size and shape for construction use.

What you are now walking on was, much longer ago, an ancient sea bottom, in the **Ordovician Period** of geologic time, a mere 460 million years ago! The land slopes slightly to the left, or uphill, which traps rainwater. This encourages the growth of plants that are typical of cedar glades - mosses and lichens. Look along the ground and rock surfaces as you hike for traces of ancient life.

## Stop 11


You are approaching very ancient life! Built by a colony of cells that secreted a shared porous skeleton, it is one of the simplest forms of multi -cellular life. Today its living relatives in the reefs of Jamaica are classified as **sponges** in phylum Porifera.

Walk slowly and look to your feet. See the rocks along the trail with bumpy surfaces? What you see is the bumpy outside of the colony. It is a **stromatoporoid**! These sclerospongia entered the fossil record some 500 million years ago and went extinct with the dinosaurs when a comet hit the Earth at the end of the Cretaceous Period. Following the deposition of the rocks in the quarry, the stromatoporoids became significant hard parts of reefs, much as the corals are today.

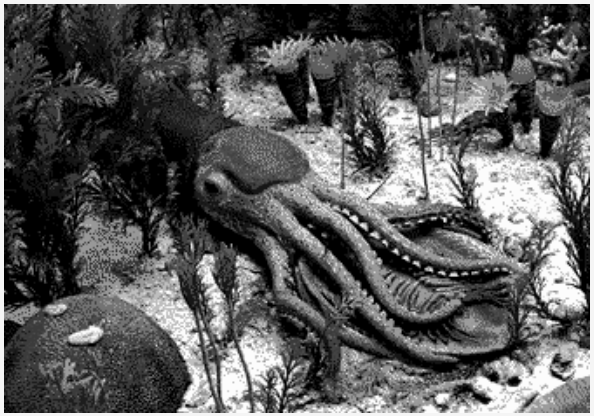
Look closely at the ground around the stromatoporoid. Do you see any more fossils? How about tiny ones? The thumbnail sized shells that you might see are **brachiopods**. There are a few branching **bryozoans**, too. You just might find other stromatoporoids, too! Keep exploring! There's much to discover!

PLEASE LOOK ONLY! LEAVE THEM FOR OTHER VISITORS TO FIND!!

## Stop 9

Have a seat and imagine that a time machine has taken you back 460 million years to the seashore where Nashville is now. What would you see, hear and smell? Seaward, there would be a huge expanse of water, much like the Gulf of Mexico now. But no fish leap from the water. Landward, there would only be flat, blinding white-lime sand. Overhead, just big sky. And you are the tallest object around! No dunes, no crying gulls, no mosquitoes or flies. Very few clouds, and much Sun! You might smell the remains of dead, tiny organisms and sea grasses that waves have swept to the high tide line.

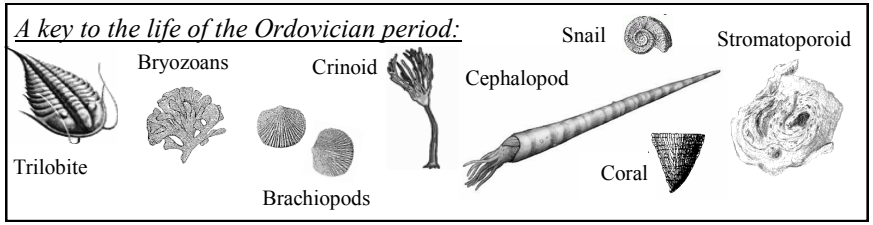
Now imagine that you are snorkeling. In the shallows, the bottom is churned up and hard to see. As the water gets deeper, it also gets clearer; the bottom is sandy with depressions containing whole shells! Sea grasses sway and an occasional **trilobite** scurries for cover! Go further. In the deeper water, the bottom is rippled mud, which is dotted with worm holes. Even farther out, the water suddenly becomes shallow and a bright sand shoal is covered with living **bryozoans**, **crinoids**, clam-like **brachiopods**, **corals**, **snails**, **stromatoporoids** and **mollusks**. Shells are everywhere. On the swim back to the beach, you spy a lone **cephalopod** feeding on a **trilobite**.



Be sure when you get back to the Nature Center, to take a look at the Geology of the Warner Parks exhibit—"Finding the Sea in Tennessee." Was it like you imagined?

Keep hiking to see this scene as it remains today!

*The next stop is the quarry. Do not follow the quarry bypass trail!*




## Stop 3

Take a look up ahead at the curvy persimmon tree. Ever see anything like that? How does a tree grow in such a fashion? Well, this is due to the tree's own growth habit and also a phenomenon known as **soil creep**, which happens in the uppermost portion of the soil. In the winter, the ground sometimes freezes and causes the soil to expand and rise just a little bit. As the ground thaws, the water in the soil melts and takes a bit of the soil downhill with it. The tree roots sense this rotating, downhill motion of the soil and gradually the trunk is leaned downhill. But remember, the tree also grows up toward the light. The result? A curvy tree! After a while, the roots grow deep enough not to sense the motion of the soil any longer and the top of the tree straightens up!
Do you see any other trees that might have experienced this?

*Stay on the yellow trail at the next intersection.*

## Stop 4

*Please stay off of all rocks to preserve them for future generations!*

Look at the many layers of rock! Some of these irregular beds of rock sweep down to the right and are pinched out. These are known as **crossbeds** because the smaller bed is at an angle to the larger primary bed. Swift flowing water in a river channel or between barrier islands at the edge of the ocean would give rise to a crossbed like this. Why do you think we find one right here?

<u>*Stay on the bridge!*</u> Look down toward your feet. A couple of feet uphill of the bridge, you'll see a rock ledge which drips water in wet weather. Do you see the crossbeds here, too? This is **Fernvale Limestone** deposited about 435 million years ago (MYA). A loose piece of this limestone would reveal that it is made up of fragments of seashells and skeletons of ancient marine invertebrates and would feel like sandpaper. Any ideas now why crossbeds would exist here in Tennessee?

It is probably because there actually was a barrier island at this location hundreds of

## Stop 5

More **outcrops** of Fernvale Limestone are exposed uphill of the trail. These layers are stacked on top of each other like a deck of cards. They continue right underneath the hill all the way to the other side!
As you leave Stop 5, you will be walking on a short **erosional terrace**, which is a natural terrace formed as a result of weathering and followed by erosion by water during heavy rainstorms**.** This terrace is cut on the bedrock near the base of the Fernvale Limestone.

## Stop 6

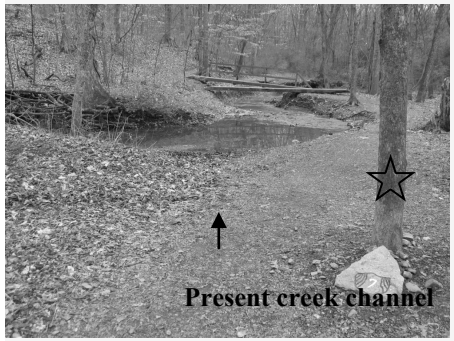
How can you tell that these large slabs of layered Fernvale Limestone are no longer attached to the bedrock and have drifted downhill? Remember the last stop? Notice the top surface of this slab is flat, but not level. It is angled slightly downhill. A ball would roll right off. On the last stop, the layers are both flat and level and extend *into* the hill – still attached – and continue straight through the hill, to the other side.

As you walk around the outcrop, take a close look at the surface ***(but please stay off)***. Notice the wavy nature of the layers. Do you see any shallow holes? These might have been the top ends of ancient burrows. The loose sands were probably stirred up by burrowing animals such as crayfish, shrimp and snails before the sand became rock.

*Follow the trail to the Old Roadway. Go left onto the road. At the fork, go right, down the hill across the large stone bridge toward the trailhead visible ahead on your left. Take the blue Harpeth Woods Trail to the left near the Trailhead.*

## Stop 7

Take a look ahead! Does it appear as if Vaughn's Creek once cut across the Natchez Trace from left to right? That's because it did! On your left, the creek now undercuts the bank exposing bedded stream alluvium of silt and clay and lots of tree roots.


Up ahead, the Harpeth Woods trail had to be re-routed across a footbridge, up the bank and down the log steps. Look at the old creek channel on your right — it has been backfilled by the creek with mounds of chert gravel. This happens in heavy rainstorms with rushing water.
*Cross the footbridge and follow the blue Harpeth Woods Trail to arrive at the rest of the Stops.*

☆ Reference tree

## Stop 8

As you climb the limestone ledges, notice that the rock appears smoother than at stops 4 and 6. This limestone is part of the **Leipers and Catheys Formations** (465-460 MYA) and generally consists of finer grained shell fragments than Fernvale Limestone. It was probably deposited in deeper water (30 -80 ft) where there was less wave action and current to separate the fine from the course particles. If you are lucky, you just might see branching twig-like fossils which are marine moss animals called **bryozoans**.

You will find photos within this trail guide and on the back cover of fossils that you are likely to see here in the Warner Parks!